# Performance Track Leading Practices

## Intel's Successful Water Conservation Program at Ocotillo

### Costs and Benefits of Water Recycling

| Costs | Savings and Other Benefits |
|---|---|
| Intel's corporate-wide costs: over $100 million. Ocotillo facility: more than $20 million.* | Builds a valuable network of collaboration with local government and community. |
| Cost of installing and operating the reverse-osmosis treatment plant. | Uses waste water, reducing cost in the long run. |
| Installing the grey water intake system. | Reduces the amount of industrial wastewater requiring treatment. |
| Minimal cost of process changes to optimize water use; fixing leaks and reducing waste. | Eliminates system shutdowns due to feed-water quality and supply issues, enabling Intel to maintain leadership in a fast-moving industry. |
| Extra equipment and effort to collect waste rinse water for internal recycling. | Protects natural systems and public health. |
| *approximate amount spent between 1998 and 2006. | Marketable improvements in corporate environmental performance. |

National Environmental PerformanceTrack
U.S. Environmental Protection Agency

EPA United States Environmental Protection Agency

## PERFORMANCE TRACK FACILITY

Intel Arizona—Ocotillo Campus,
Chandler, Arizona

## GOAL CATEGORY

Water Use

## RELATED INDICATORS

Quantity of Water Used (gallons)

## OVERVIEW

The reduction, reuse, and recycling of water has become a critical area of improvement for facilities across the United States. Water should be sourced carefully, and it also requires immense quantities of energy to treat and transport. To effectively manage this critical resource, Performance Track facilities have developed leading-edge practices in water conservation through improvements made in the Water Use goal category.

Intel's manufacturing and development facility at Ocotillo has had an extensive water conservation and recycling program since the facility broke ground in the mid-1990s. Located just outside Chandler, Arizona, Ocotillo requires up to 4 million gallons of water a day to supply three "fabs" (semiconductor factories) located on the 700-acre site. Before the fabs were built, Intel and the municipality of Chandler partnered to install a reverse-osmosis facility that treats and recharges drinking water quality water back to the underground aquifer.

Over the course of its water management partnership, Intel and the City of Chandler have recharged approximately 1 billion gallons of municipal water back into the aquifer, and, after more than a decade of strategic infrastructure development and conservation measures, the Ocotillo facility treats or recycles for internal or external use up to 75 percent of the water used during manufacturing. Careful planning and collaboration with the local municipality gave Intel room to expand while ensuring that the area's water resources would be managed sustainably for the future.

## HOW THE WATER RECYCLING SYSTEM WORKS

Recycling water at a semiconductor facility like Ocotillo involves the reuse of water used in wafer processing. The stage where most of the water is consumed occurs during the rinsing process. Ocotillo's water conservation system is part of a corporate-wide environmental strategy based on Design for the Environment principles, which emphasize continuous improvement through innovation and aggressive waste and resource management. Intel's four-tiered approach to water management on the Ocotillo campus has been a driving force behind this program's success, as well as a cornerstone of its Performance Track goals. The approach covers four areas:

- ★ Aquifer recharge in partnership with the City of Chandler
- ★ Internal water reuse in mechanical systems

- ★ Reuse of treated effluent (grey water) from external sources in mechanical systems and landscaping
- ★ Implementation of new process technologies that use less water

To recharge the local aquifer, Intel partnered with the local municipal government to build a reverse-osmosis treatment plant. Intel reached out to the community of Chandler early on, identifying the needs of the city and investing in infrastructure improvements accordingly. By being proactive and planning for increased water consumption, Intel avoided the extra costs of retrofitting to offset its growing demand for incoming city water.

Internal water reuse in the facility's mechanical systems is a second water reduction strategy currently underway at Ocotillo. This approach involves the reuse of water in areas where the quality of water is not a primary concern. Rejected water from the reverse osmosis process, along with spent rinse water, are good candidates for this type of reuse. When reusing water internally, water that contains corrosive ions that could damage equipment components should be avoided. Additional treatment may be necessary prior to reuse, such as alkalinity adjustments.

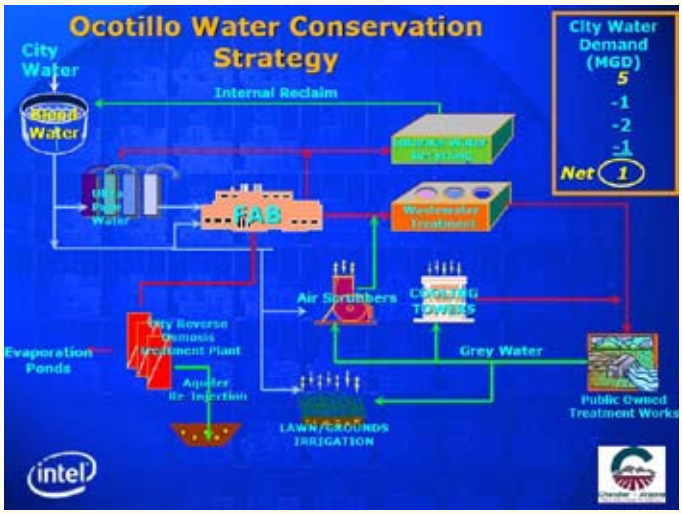
Intel Ocotillo also uses treated effluent, or grey water, in its industrial systems (scrubbers and cooling towers) and for site-wide irrigation. This practice minimizes industrial demand on potable fresh incoming city water, a scarce and expensive resource in the Desert Southwest.

New process technologies at Ocotillo that optimize water use efficiency are specific to the wafer-production process and involve shifting the proportions of reclaimed water/fresh water blends in the cooling towers. The previous configuration for the cooling towers used a blend of internal reuse water, reclaimed water, and municipal water. To offset increased demand for internal reuse water in scrubbers, the facility increased the amount of reclaimed water used in cooling tower makeup to 73 percent.

## IMPLEMENTATION

Facilities such as Ocotillo share a common challenge in their water management strategies: developing higher product performance and reliability can involve manufacturing processes that are more complex and water-intensive. This means facility managers will need to work harder to implement long-term commitments to water conservation and efficiency. It is critical that water use improvements are measured and calculated, an area that can be facilitated by an Environmental Management System (EMS) and participation in Performance Track.

At Ocotillo, flows that are sent to the City of Chandler's reverse osmosis plant for recharge are monitored using continuous flow totalizer meters. Incoming city water and reclaimed water are measured via flow totalizer meters that are installed on-site, and internal water reuse is tracked using flow meters. Monthly readings are taken on the meters and these data are compiled and aggregated through the facility EMS. The data can then be used for internal and Performance Track reports. Having the right instruments and the right monitoring processes in place are critical to any effective water management plan—a facility cannot improve what it cannot measure.




*An illustrated diagram of Intel Ocotillo's Water Conservation Strategy.*

## BENEFITS OF WATER RECYCLING

Intel corporate has invested more than $100 million over the past decade in water conservation programs globally. As a result of its water recycling efforts, the Ocotillo campus took back 848 million gallons of treated wastewater from the city plant, internally reused 559 million gallons of water, and treated 676 million gallons of water to drinking water standards to return to the local underwater aquifer.

By conserving water, Ocotillo has been able to increase production while mitigating the risks of disruptions associated with water shortages and quality issues. Benefits include direct cost savings on water bills; cost savings through reduced energy requirements for heating, pumping, and treating water; and increased productivity and process efficiency through optimized production cycles. Furthermore, facilities can leverage their water conservation efforts to improve relationships with stakeholders and as a way to network and collaborate on new and better ways of continuous improvement. Ocotillo provides a clear road map for water use improvement and more examples can be found throughout the network of National Performance Track facilities.

## RESOURCES FOR MORE INFORMATION

- ★ EPA's WaterSense Program [http://www.epa.gov/owm/water-efficiency/index.htm] presents sector-specific suggestions for water conservation measures, guidelines for developing water conservation plans, and information on specific water conservation measures. See WaterSense publications on water efficiency for Industry [http://www.epa.gov/WaterSense/docs/industry508.pdf] and Commercial Businesses [http://www.epa.gov/WaterSense/docs/commercial508.pdf].
- ★ The Global Reporting Initiative Water Protocol (PDF, 1MB, 48 pp) [http://www.aeca.es/comisiones/rsc/documentos_fundamentales_rsc/gri/technical_protocols/gri_water_protocol.pdf] includes comprehensive measurement guidelines for a variety of water indicators, including total water use. Annexes 1, 2, and 3 provide a worksheet for estimating water balance, conversion factors, and a step-by-step guide to conducting a water audit.